drainage from the mucous surface of the cervical canal is upward and outward through the musculature of the uterus toward the serous coat, from where the lymphatic vessels leave the uterine surface by way of the sacro-uterine and broad ligaments, and it is this path by which the infection reaches the pelvic organs. The milder infections of the cervical glands seem to cause the production of thicker mucus plugs, while the more virulent infections cause a more serious discharge but extend to the adnexae earlier and with more disastrous results.

In these 230 sterile patients, pelvic inflammation seems to be the most important single condition causing sterility, showing 56 per cent infected. The indication is for early and thorough treatment of the cervix to prevent local barriers to the ingress of spermatozoa and to prevent internal extension of the infection which may cause permanent destruction of the generative organs.

TABLE I

STERILITY—230 CASES

Av. Duration Sterility	Average Age	Cervicitis	Pelvic Inflammatory Disease	Stenosis	Infantile	Polyp
5 yrs	29	129	72	11	7	1
		56%	31.3%	4.7%	3.0%	0.4%

TABLE II

TUBAL PATENCY RESULTS

44 Sterile Cases

Cervix	Number	Tubes Open	Tubes Closed
Clean	14	14	0
Infected	30	8	22

TABLE III

CERVICITIS—125 CASES

Average Age 26

Cervicitis	Pelvic Inflammatory Disease	Endometritis	Primary Sterility
125	46	16	42
100%	37%	13%	33.6%

THE ADNEXAL ORGANS IN RELATION TO STERILITY*

By C. W. ANDERSON, M. D., Los Angeles

The increased knowledge of the physiology and pathology of the ovary, which has come with the wonderful advances made in the study of the endocrine system, as well as the epoch-making contribution of Rubin to the diagnosis of tubal conditions, have given an unprecedented impetus to the study of the whole subject of sterility.

The tubes and ovaries play a very important part in the production of sterility and until comparatively recently the blame for almost all cases of sterility was laid at the door of the tubes.

I would like to discuss this subject under the headings:

1. Pathological conditions of the tubes and ovaries causing sterility.
2. Their diagnosis.
3. Their treatment.

It is hardly necessary for me to say, by way of introduction that one of the conditions necessary for impregnation is a tube offering an open channel for the ovum to descend and the spermatozoon to ascend, and that any condition which interferes with these functions is a potential cause of sterility.

Infantilism occasionally manifests itself in a persistence of the spirally twisted condition of the tube, which is common in early life. This may cause sufficient obstruction in the lumen of the tube to prevent the free passage of the ovum or spermatozoon and hence be a cause of sterility. In most cases of this kind evidences of infantilism are present in other parts of the generative system, and make it all the more improbable that pregnancy can occur.

Acute appendicitis in childhood or early womanhood may be a factor in producing sterility in later life. Graves (Archives of Surgery 1921-2, 315) has particularly called attention to this subject. He believes that very frequently the serofibrinous exudate from the region of the inflamed appendix gravitates to the pelvis and sets up sufficient peritonitis to cause occlusion of the abdominal ostium of the tube. This would explain many of our cases of occluded tubes in which no history of gonorrhoeal or other pelvic infection is obtainable.

Salpingitis is by far the most important factor in impairing the functional value of the tube as an oviduct. Curtis (Surgery, Gynecology and Obstetrics, December, 1921) gives the results of the bacteriological and pathological investigation of fallopian tubes removed at operation from 300 patients. Not only were smears made from the fluid in these tubes, but the tubes themselves were ground up and cultured. He concluded that the gonococcus was responsible for approximately 80 per cent of these cases, other pus-producing bacteria, notably various types of streptococci, caused 15 per cent, while evidence of tuberculosis was found in 5 per cent.

In this discussion we are especially interested in the end results of infections, for it is these which cause sterility. It was formerly believed that when once a patient had developed gonnorrhoeal salpingitis she was doomed to permanent closure of both tubes with resulting sterility. More careful study of these cases has proven that gonorrhoeal salpingitis, more than any other type of salpingitis, shows a tendency to spontaneous recovery, and that many women with bilateral gonorrhoeal salpingitis have recovered and subsequently borne children. A single attack of mild gonorrhoeal salpingitis frequently leaves no bad after effects. Those tubes, however, which are subjected to a severe attack of salpingitis, or frequent reinfection from a focus, such as an endocervicitis, are apt to be permanently damaged. In such cases the fimbriated extremity very frequently becomes occluded either by retraction or adhesion of the fimbriae, or by a plastering of the end of the tube to the ovary, or some adjacent structure.

*Read to the Section on Obstetrics and Gynecology at the Fifty-second Annual Session of the California Medical Association.

This may be followed by distention of the tube with formation of pyosalpinx, hydrosalpinx, or heamatosalpinx. The perisalpingitis in gonorrhoeal cases is not usually so crippling in its results, nor so permanent as in other infections. Some authorities state that at operation one can differentiate between gonorrhoeal and other forms of salpingitis by the density of the adhesions, and the difficulty encountered in their separation. The gonorrhoeal cases usually separate much more readily than the others, but it must be remembered that there are notable exceptions to this rule.

Sometimes the tube remains open at the abdominal extremity, but closed in some other part of its course. This is due to extensive destruction of epithelium with adhesion between the folds of the mucosa. Serious damage to the lining of the tube is more common after gonorrhoeal infection than that caused by the streptococcus.

In post-puerperal and post-abortal infections perisalpingitis and persistence of infection are the most notable features. There is less damage done to the endosalpinx, but the adhesions to surrounding structures are more dense and show less tendency to be absorbed. Streptococci may be obtained from tubes months or even years after the acute process has subsided, while gonococci usually become inactive two or three weeks after the disappearance of fever and leucocytosis (Curtis).

In tuberculosis of the tubes, adhesions are usually very dense, the tubes are much thickened due to hyperplasia of the mucosa, but occlusion of the fimbriae is not so frequent as in gonorrhoeal tubes of the same severity. Needless to say sterility is the rule in such cases.

Tumors of the fallopian tubes are too rare to require more than passing mention.

Pathological condition of the ovary causing sterility.

A second condition necessary to impregnation is an ovary producing and discharging healthy ova. S. R. Meaker (Boston Medical and Surgical Journal, October, 1922) groups the disorders interfering with this condition under four headings:

1. Constitutional.
2. Toxic.
3. Endocrine.
4. Mechanical.

Constitutional causes are such as malnutrition, anaemia, cachexia and those conditions arising from faulty diet and hygiene. Reynolds (American Journal of Obstetrics and Gynecology, October, 1921) has shown by experimental work that a decrease in the fat soluble vitamine, of the protein or of the calcium contained in an otherwise excellent diet produces a definite decrease in the fertility of individual rats. It is fair to conclude that the same is true to some degree in women.

Of toxic conditions the most important are syphilis, mumps, chronic poisoning from alcohol, morphin, arsenic, phosphorus and lead.

Endocrine sterility includes cases of infantilism, where the ovaries have never developed, as well as those in which sexual activity wanes early in life.

The mechanical disorders which cripple the ovary are largely the result of inflammation. The whole subject of oophoritis is in a very unsettled state, but that such a condition does exist, and that it is frequently followed by adhesions of the ovary to adjacent structures, by thickening of the tunica albuginea, and by increase of the interstitial connective tissue is generally admitted. These conditions interfere with the normal maturation of the Graafian follicle and with the discharge of the ovum and consequently are causes of sterility.

Conception seldom takes place in the presence of double ovarian tumors or dermoid cysts.

Diagnosis.

The important point in diagnosis in a case of sterility in which the tubes are suspected is not so much what pathological condition, if any, is present, but whether the tubes are patent or occluded.

In the past the great barrier to the study of the tubes has been the fact that it was necessary to perform a laparotomy to determine whether the tubes were patent or not. Most women hesitate to undergo such an operation when they can not be assured that there is a condition in the tubes requiring operation, and further that there is not a fifty-fifty chance of a good result even if the tubes are found to be closed.

This barrier has largely been removed by the introduction by Rubin of the gas-inflation test.

Briefly the test consists in passing carbon dioxide gas through the uterus and tubes, followed by its demonstration in the peritoneal cavity by the use of the X-rays. The apparatus necessary for Rubin's test is: (1) a tank of carbon dioxide gas with a pressure gauge to control the rate of flow, (2) a glass chamber containing a volumeter to measure the amount of gas, (3) a mercury manometer to register the pressure of gas, (4) an intrauterine canula of the Keyes Ultzmann type fitted with a rubber stopper to block the cervical canal, (5) rubber tubing to connect the various pieces of apparatus.

Rubin has found that the most satisfactory rate of flow of the gas is that which will register 100 mm. mercury in fifteen seconds when the outlet to the uterine canula is blocked. The amount of gas used to determine the patency of the tubes is about 160 cc., which is indicated by four pulsations of the volumeter.

The technique of the test is as follows: The patient is placed in the lithotomy or Sims position, an appropriate speculum introduced, the vagina is cleansed and any mucus present in the lower part of the cervical canal removed, cervix and endocervix painted with iodine. The direction of the uterine canal is determined accurately with a uterine sound. The apparatus having been prepared with gas flow properly regulated, the sterile intrauterine canula is introduced well beyond the internal os., the rubber stopper completely closing the cervical canal. It is seldom necessary to grasp the anterior lip of the cervix with a tenaculum as recommended by some authors. The gas is turned on and the manometer carefully watched.

In patent cases the pressure will rise to a point somewhere between 50 and 150 mm., then drop sharply to 40 or 50 mm., at which point it fluctuates as long as the gas is flowing. If the pressure

goes above 150 mm. and then falls rapidly, it is interpreted as indicating that there was some obstruction in the canal caused by a kink or a plug of mucus, and that the kink has been straightened out or the plug dislodged. A repetition of the test in such cases usually shows a frankly patent tube.

If the pressure rises above 150 mm. and then falls very slowly it indicates a stenosis of the tubes, which permits the gas to pass very slowly. It may indicate a closure of one tube, and a stenosis of the other. Some investigators believe that they can locate such a stenosis by auscultation over the lower abdominal quadrants, the whistling sound of the gas going through a narrow opening indicating the side of the stenosed tube.

If the pressure rises to 200 mm. on repeated tests, a diagnosis of non-patency can be made.

After the pneumoperitoneum is produced patients usually complain of pains in the abdomen, like gas pains. When they are allowed to sit up, the gas rises to the space between the liver and the diaphragm and pain in the right shoulder is almost invariably noted. At this point the patient may be fluoroscoped and the presence of a pneumoperitoneum made certain by the appearance of a halo over the dome of the liver. Many observers feel that this is unnecessary and rely on the shoulder pain as conclusive evidence of pneumoperitoneum.

I believe that at least for those inexperienced in this work it is advisable to check up by the use of the fluoroscope.

At first sight it would seem that there would be danger of forcing infectious material out through the tubes into the pelvic peritoneal cavity. Experience in hundreds of cases has shown that the reaction in the pelvic peritoneum is insignificant, or entirely absent. I have not found one case reported where there has been a serious reaction. The pain caused by the presence of carbon dioxide in the peritoneal cavity is of very short duration, seldom lasting more than thirty minutes.

There are, of course, certain contraindications to the use of this test, which must be carefully adhered to. Acute infections of the vagina, or pelvic organs are absolute contraindications. In chronic infections associated with pain the examination had better be deferred until the pain has cleared up. The test should not be performed just before or after a menstrual period. Patients with myocardial disease are not good subjects for inflation.

This test has been used in such a large number of cases, by some of the most competent men in this country, that we must realize that it is an accepted addition to our diagnostic and perhaps therapeutic armatentarium, and that no patient should be submitted to an abdominal operation for the cure of sterility until the non-patency of the tubes has been demonstrated by tubal inflation.

Modifications and simplifications of this test have been suggested. One worthy of note is that of Furniss (Surgery, Gynecology and Obstetrics, November, 1921). He used a tight-fitting 30 cc. Luer syringe with a T connection. The right angle arm of the T goes to a manometer, while the direct tube connects the syringe to the intrauterine canula. The patient is put in the Trendelenburg position, with the hips elevated, a bivalve speculum introduced into the vagina, the canula introduced, and the vagina flooded with boracic acid solution. Furniss states that 15 cc. is the maximum capacity of the uterine canal and tubes. Therefore 30 cc. of carbon dioxide gas is injected, and if no gas bubbles back from the cervix, then the gas must have escaped through the tubes. I have not tried this simple technique, but cannot see why it should not be satisfactory.

Diagnosis of conditions of ovary.

With the exception of tumors and cysts of the ovary the diagnosis of the ovarian condition present can best be made by careful consideration of the history.

For example, with all other causes of sterility eliminated as carefully as possible, and with a previous history of pelvic inflammation followed by irregular, scanty and painful menstruation, added to the finding of a small, fixed, painful ovary, one would be justified in concluding that the ovary was the seat of the trouble. Fine differential diagnoses in such cases are not to be considered. One must keep in mind the possibility of constitutional, toxic and endocrine causes, as mentioned above.

Treatment.

The relief of sterility by operation on the tubes and ovaries has never been a very optimistic chapter in the history of surgery. Some surgeons state that they have never seen pregnancy follow plastic surgery on the tubes, while others claim a fair share of success. On the whole, the tendency at the present time is towards optimism and this is based largely on better selection of cases due to the possibility of more accurate diagnosis.

The therapeutic value of gas inflation seems to be forcing itself on the minds of all who are using this method. Many of the recent articles on gas inflation state that a certain percentage of their cases become pregnant very soon after they have been tested, suggesting that a very slight obstruction in the tubes has been removed by the passage of the gas.

The strong argument against salpingostomy has always been that there would be sufficient reaction following operation to close the new ostium. It is only logical to believe that repeated inflation at short intervals following this operation will tend to keep the tubes open.

The standard operations on obstructed tubes consist of some method of dilation in the mild cases, and salpingostomy or salpingectomy with implantation of part of the ovaries in the uterine coruna in the severe cases.

With the abdomen open a slight stenosis or kinking of the tube may be relieved by the passage of probes, or pneumatic dilation. In sterile patients who are being subjected to abdominal operation, Curtis (A. M. A. Journal, February, 1923) recommends the distention of the tubes by the use of air forced in by a Luer syringe placed at the fimbriated extremity of the tube. He states that "this procedure reveals the presence of otherwise undemonstrable obstruction within the tube, minor

strictures when discovered may be overcome by forcible syringe pressure, the anatomic limitations of grossly palpable obstruction, possibly amenable to plastic surgery, may be more definitely determined, and at the completion of plastic operations on the tube, it is possible to test the patency of the reconstructed lumen."

Blair Bell (Oxford Surgery, Vol. 5, page 242) states that salpingostomy is seldom indicated for a closure of fimbriated extremity due to primary salpingitis, as the uterine end of the tube is frequently blocked in this condition. In cases where the infection has spread to the covering of the tube, from such conditions as appendicitis, the lining membrane of the tube is usually intact and salpingostomy is indicated.

In extreme cases, where both tubes are damaged beyond repair, but one or both ovaries are in fair condition, one may try extirpating the tubes and planting a piece of ovary in each uterine cornu. A few successful cases of this kind have been reported (Graver's Gynecology, page 265), but the chance is a long one.

Conditions of the ovary leading to sterility do not offer an attractive field for surgery. Perhaps organotheraphy offers a more hopeful outlook.

In conclusion, I would urge a more careful study of women complaining of sterility, emphasizing especially the value of the inflation of the tubes as a means of diagnosis.

In cases of non-patency where there is no evidence of serious damage to the lining of the tubes, and where the ovary seems to be normal, I would advise salpingostomy followed by gas inflation at regular intervals to preserve the patency of the new ostium.

We have to admit that the results of this work in the past have not been very brilliant, but I believe that we may fairly look forward to good results in the future, provided that only those cases are submitted to operation in which common sense tells us that there is a reasonable expectation of a cure.

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"Throw Away Your Glasses"—In the September number of Hearst's International appears a contribution entitled "Throw Away Your Glasses," by one W. H. Bates, M. D. The article is an unfortunate hoax for thousands, even tens of thousands, of persons who will be cruelly deluded by its irrational bunkum. It presents a half-baked theory, based on the crudest of experimental work, elaborated in a pseudo-scientific manner and presumably broadcast by the magazine because of its sensational title. Half or less than half truths are announced as facts without any investigation of underlying anatomic and physiologic conditions, and with no careful experimental study. Certainly the case reports are too questionable to stand thorough analysis. The entire matter illustrates again the danger of unauthoritative instruction of the public in medical matters. One article of this character may undo the good work of years by committees and councils for the conservation of eyesight; it will lead into false paths many of the afflicted who were progressing slowly but surely on the road to recovery. An editor's note indicates that the article is sponsored by Mr. Norman Hapgood himself. Where did Mr. Hapgood acquire his knowledge of the science of ophthalmology?—Jour. A. M. A., Sept. 1, 1923.

TUMORS AND DISPLACEMENTS IN RELATION TO STERILITY*

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This paper is limited to the discussion of fibroids and retroversions and retroflexions as causes of sterility.

FIBROIDS AND STERILITY

There is no doubt but that the fibroid statistics of the literature show a higher proportion of sterile marriages than of married women in general. The figures for married women, as a class, vary considerably. They depend for the most part upon the frequency of the common causes of sterility such as preventives for conception, tubal and ovarian inflammation, anatomical defects, etc., some of which may operate equally well in women who have had or subsequently will have fibroids. Sterility in women who have been under treatment for some medical or gynecological condition varies between 7 and 21 per cent. Goetze found that 7 per cent of 730 gynecological cases were sterile, the series including some fibroids. Hofmeier found 8.1 per cent of sterility in 5462 clinic cases in contrast with 17 per cent for 2795 private cases. Sterility in the married women of the series of Sims, Simpson, Wells and Duncan ranged from 8 per cent to 15 per cent. Young and Williams found sterility in 10.5 per cent of 238 medical cases who had no pelvic complaints. Grunewaldt recorded sterility in 21 per cent of 900 gynecologic cases and felt that developmental arrests were responsible for the condition in all cases. On the contrary, sterility is said to exist in approximately 30 per cent of married women with fibroids. Olshausen found this percentage in the 1730 married women constituting the series reported by West, Roehrig, Beigel, Schumacher, Scanzoni, Michels, Winckel, Schorler and Hofmeier. When reviewing this subject some years ago, I found certain errors in some of the tables forming the basis of Olshausen's calculations, yet they did not affect the percentage in an appreciable manner. Adding to this series, the cases of Schroeder, Young and Williams, Haultain, Goetze and Kelly and Cullen, we found that 31.5 per cent of the 3617 cases were sterile. My individual series shows about the same proportion. Only 169 of the 215 fibroid cases in the married women of my series had had children, a sterility of 31.8 per cent.

The above shows that there is twice as much sterility in fibroids in married women as is found in married women in general who have been under medical care. Our first part of the problem is to find whether sterility may result from the tumor itself. There is some evidence in favor of the positive view, since the percentage of sterility has been shown to vary according to the size and location of the tumor. It is usually believed that sterility is most common in the cases with submucous tumors, but this idea is not confirmed by the literature. It is of interest in this connection

*Read to the Section on Obstetrics and Gynecology at the Fifty-second Annual Session of the California Medical Association.